APPENDIX G

Dedicated Sampling Pump Specifications

SECTION 9000
ENGINEERING SPECIFICATION: DEDICATED GROUND-WATER SAMPLING SYSTEM SPECIFICATION

PART 1 --- GENERAL

1.1 SCOPE

1.1.1 The manufacturer shall furnish a dedicated ground water sampling system with one or more bladder pumps and associated tubing, well caps and controls for the collection of ground water quality samples.

1.2 PROCESS DESCRIPTION

1.2.1 A bladder pump allows water to flow through an inlet check valve into the interior of the pump bladder due to the pressure gradient exerted by the hydrostatic head of the water it is submerged in. After the interior of the bladder is filled with water, compressed gas is applied to the exterior of the bladder to force the water to flow through an outlet check valve and out of the pump. The compressed gas is delivered to the pump through a gas supply tube connected to a compressed gas source with a control device located at the wellhead, and the pump liquid discharge is delivered to the wellhead through a water discharge tube with both tubes terminating in a wellhead cap. The water pumped and conveyed in a manner to minimize alteration of water quality in any way. When the pump bladder is squeezed sufficiently to empty it of water, the compressed gas control device stops the flow of compressed gas and vents the pump's gas supply tube to the atmosphere. This venting allows the pressure on the outside of the pump bladder to decrease to less than that of the hydrostatic head present at the pump inlet due to the pump's submergence. The pump bladder can thereby refill and repeat the cycle as needed to achieve desired flow for purging and sampling the well. The pump controller at the wellhead controls the sequencing of applying compressed gas to and venting of the pump. A compressed gas source at the wellhead provides the necessary flow of compressed gas to the controller. A water level measurement device allows measurement of water levels in the well before and during pumping, and can be connected to the pump controller to temporarily cease pumping when the water level in the well is drawn down beyond preset limits. A flow cell connected to the water discharge tube measures water quality parameters and provides indication of completion of well purging.

1.3 SUBMITTALS

1.3.1 Manufacturer shall submit the following with the bid:

1.3.1.1 Product data for selected models, including dimensions, materials of construction, pressure and depth ratings, flow capacity, weights, measurement accuracy, accessories and warranty coverage. See attached data sheets for full specifications.

PART 2 --- PRODUCTS

2.1 GENERAL

2.1.1 The sampling system shall be a Well Wizard dedicated bladder pump system with MicroPurge controls and accessories. See data sheets for model number(s). Equipment shall be manufactured by QED Environmental Systems Inc. and represented by _____ or pre-approved equivalent.

2.1.2 All components and options shall meet requirements specified on the data sheets attached to this specification.

2.2 EQUIPMENT DESIGN REQUIREMENTS

2.2.1 Standard product design shall include complete bladder pump assembly, with all fittings, check valves, bladder and inlet screens with the following specifications:

2.2.1.1 The bladder pumps shall be of squeeze-type design, with water entering the interior of the bladder tube, and air pressure applied to the annular space between the exterior of the bladder and the interior of the pump body.

2.2.1.2 The pump shall be capable of running dry without any damage to the pump, controls or power source.

2.2.1.3 The pump shall also be capable of continuous operation for a minimum of 12 hours at a low rate of 0.1 L/minute or less without damage, malfunction or automatic shutdown.

2.2.1.4 The pump must be capable of lifting water from 300 feet without modification.

2.2.1.5 The bladder and all other pump components must be able to withstand 150 PSI differential pressure without damage or malfunction.

2.2.1.6 The pump assembly must be able to withstand a submergence of at least 200 feet and an inlet pressure of at least 85 PSI without damage to the bladder or other components; and without slippage of the bladder from its mounting or leakage around the bladder mounting seal.

2.2.1.7 Bladders shall be Dura-Flex Type-62 Teflon, field replaceable, and capable of a minimum of 200,000 cycles of operation without failure or leakage. Evidence of this performance must be supported by a minimum of ten years of production QC testing data from the manufacturer of the pumps.

2.2.1.8 The pump assembly must be cleaned using a multi-stage washing and rinsing process utilizing phosphate-free laboratory-grade detergent and deionized and filtered water. The cleanliness of the pumps must be certified by soaking the pumps for at least 24 hours in reagent-grade water, with internal recirculation of the water through each pump assembly. Samples of the final soak water shall be analyzed by an independent EPA-certified laboratory for EPA Method 8260 and 625 volatile organic compounds, acid extractable and base-neutral compounds, and results of the analysis correlated to each pump through a numbered and signed certification tag attached to the pump. The efficacy of the cleaning and certification process must be supported by a minimum of ten years of production QC testing data from the manufacturer of the pumps.

2.2.1.9 The pump and tubing when assembled must have a minimum tensile strength of 150 pounds without the use of an auxiliary support cable to prevent pump loss and fitting leakage.

2.2.1.10 The pump and all of its components including the bladder shall be covered by a minimum standard warranty of 10 years provided by the manufacturer of the pump.

(Choose for PVC Pump)

2.2.1.11 The bladder pump shall have an overall length of 42 inches, an outside diameter of 1.66 inches, and a bladder capacity of 395 milliliters; or (where the application warrants) an overall length of 19.5 inches, an outside diameter of 1.66 inches, and a bladder capacity of 130 milliliters.

2.2.1.12 The pump must be constructed entirely of PVC and PTFE materials, with lead-free Viton® o-rings. The materials used in construction of the pump, including external fittings and connections, must be virgin-grade first-run quality, with no reprocessed or reground ingredient, additives or fillers used.

2.2.1.13 All PVC components used must be NSF-grade, extruded specifically with no markings or lubricants.

2.2.1.14 Each pump shall be fitted with a PVC inlet screen, 6 inches in length, and having a screen opening size of .010 slot. The screen shall attach directly by threading to the pump inlet housing.

2.2.1.15 To provide steady low-flow pumping rates and to minimize sample aeration in the discharge tube and the introduction of air into in-line flow cells, the pump shall have a check valve design that typically allows less than 0.1 ml/minute drainback during the pump refill cycle, and in no more than 0.5 ml/minute drainback during refill.

(Choose for Stainless Steel/Teflon Pump)

2.2.1.16 The bladder pump shall have an overall length of 42 inches, an outside diameter of 1.5 inches, and a bladder capacity of 495 milliliters; or (where the application warrants) an overall length of 15 inches, an outside diameter of 1.5 inches, and a bladder capacity of 100 milliliters.

2.2.1.17 The pump must be constructed entirely of Type 316 stainless steel and PTFE materials, with lead-free Viton® o-rings. The materials used in construction of the pump, including external fittings and connections, must be virgin-grade first-run quality, with no reprocessed or reground ingredient, additives or fillers used.

2.2.1.18 All stainless steel components of the pump, including the body, discharge nipple, center discharge rod, fittings, center rod and body cross pins, and inlet screen assembly must be electropolished to remove all traces of embedded scale, rust, foreign debris, oils and grinding compounds from manufacturing; and to passivate the surface of the metal to protect against corrosion, tarnish or oxidation that could affect sample chemistry.

2.2.1.19 The pump fittings must be type 316 Stainless Steel, compression-type design with a two-part ferrule and outer compression nut, as manufactured by Swagelock®, with special provision made to ensure elimination of the standard metal coatings normally present on the threads.

2.2.1.20 Each pump shall be provided with a fine stainless steel mesh inlet screen

assembly to protect the pump from malfunction or damage by large solids. The inlet screen shall be 6 inches in length, and of .010 mesh. The screen shall attach to the pump inlet housing by means of stainless steel set screws.

2.2.1.21 To provide steady low-flow pumping rates and to minimize sample aeration in the discharge tube and the introduction of air into in-line flow cells, the pump shall have a check valve design that typically allows less than 0.1 ml/minute drainback during the pump refill cycle, and in no more than 0.5 ml/minute drainback during refill.

(Choose for High Pressure Stainless Steel/Teflon Pump)

2.2.1.22 The bladder pump shall have an overall length of 42 inches, an outside diameter of 1.66 inches, and a bladder capacity of 395 milliliters.

2.2.1.23 The pump must be constructed entirely of Type 316 stainless steel and PTFE materials, with lead-free Viton® o-rings. The materials used in construction of the pump, including external fittings and connections, must be virgin-grade first-run quality, with no reprocessed or reground ingredient, additives or fillers used.

2.2.1.24 All stainless steel components of the pump, including the body, discharge nipple, center discharge rod, fittings, center rod and body cross pins, and inlet screen assembly must be electropolished to remove all traces of embedded scale, rust, foreign debris, oils and grinding compounds from manufacturing; and to passivate the surface of the metal to protect against corrosion, tarnish or oxidation that could affect sample chemistry.

2.2.1.25 The pump fittings must be type 316 Stainless Steel, compression-type design with a two-part ferrule and outer compression nut, as manufactured by Swagelock®, with special provision made to ensure elimination of the standard metal coatings normally present on the threads.

2.2.1.26 Each pump shall be provided with a fine stainless steel mesh inlet screen assembly to protect the pump from malfunction or damage by large solids. The inlet screen shall be 6 inches in length, and of .010 mesh. The screen shall attach to the pump inlet housing by means of stainless steel set screws.

(Choose for Teflon Pump)

2.2.1.27 The bladder pump shall have an overall length of 42 inches, an outside diameter of 1.5 inches, and a bladder capacity of 495 milliliters; or (where the application warrants) an overall length of 15 inches, an outside diameter of 1.5 inches, and a bladder capacity of 100 milliliters.

2.2.1.28 The pump must be constructed entirely of PTFE materials, with lead-free Viton® o-rings. The materials used in construction of the pump, including external fittings and connections, must be 100% virgin-grade first-run quality, with no reprocessed or reground ingredient, additives or fillers used.

2.2.1.29 Each pump shall be fitted with a Teflon inlet screen, 6 inches in length, and having a screen opening size of .010 slot. The screen shall attach directly by threading to the pump inlet housing.

2.2.1.30 The bladder pumps shall be of squeeze-type design, with water entering the interior of the bladder tube, and air pressure applied to the annular space between the exterior of the bladder and the interior of the pump body.

2.2.1.31 The pump shall be capable of running dry without any damage to the pump, controls or power source.

2.2.1.32 The pump shall also be capable of continuous operation for a minimum of 12 hours at a low rate of 0.1 L/minute or less without damage, malfunction or automatic shutdown.

2.2.1.33 The pump must be capable of lifting water from 300 feet without modification.

2.2.1.34 The bladder and all other pump components must be able to withstand 150 PSI differential pressure without damage or malfunction.

2.2.1.35 The pump assembly must be able to withstand a submergence of at least 200 feet and an inlet pressure of at least 85 PSI without damage to the bladder or other components; and without slippage of the bladder from its mounting or leakage around the bladder mounting seal.

2.2.1.36 Bladders shall be Dura-Flex Type-62 Teflon, field replaceable, and capable of a minimum of 200,000 cycles of operation without failure or

leakage. Evidence of this performance must be supported by a minimum of ten years of production QC testing data from the manufacturer of the pumps.

2.2.2 Pump Tubing

2.2.2.1 Each pump shall be supplied with tubing to meet the following specifications;

2.2.2.2 The air supply and discharge tubing shall be thermally bonded together for installation as a single line, without any external sheathing material or cable ties. The air supply and discharge tubing shall be able to be separated without the use of any tools for attachment to fittings. Once separated, the remaining bonding ridge shall not require trimming or removal for installation into a compression-type fitting for leak-tight connection to compression type fittings.

2.2.2.3 Tubing shall be ¼" air supply, with discharge sized to match the bladder pump. The tolerance on the diameter shall not exceed + 0.05 inches, and shall fit into standard-sized compression-type fittings without trimming, reaming or resizing.

2.2.2.4 The tubing shall have a minimum bend radius of 1.25 inches, and must be able to withstand 300 PSI working pressure.

2.2.2.5 All materials must be 100% virgin-grade, extruded in the USA with US-manufactured resins, with no regrind materials, additives, fillers, mold release agents or printing.

2.2.2.6 Each tubing bundle shall be provided with inserts (material to be compatible with the pump construction) needed for secure connection to the pump and wellhead assembly.

(Choose for Polyethylene Tube)

2.2.2.7 The tubing shall be manufactured of all polyethylene.

(Choose for Teflon-Lined Polyethylene Tube)

2.2.2.8 The tubing shall be manufactured of polyethylene, with the discharge tubing having an inner-wall lining of Teflon.

2.2.2.9 The tubing shall be provided with rigid inserts inside the end of the tube connected to the pump fittings, to prevent discharge flow from being blocked due to the Teflon lining being pushed or peeled back into the liquid flow path.

(Choose for Teflon Tube)

2.2.2.10 The tubing shall be manufactured of all Teflon.

2.2.3 Wellhead Cap Assembly

2.2.3.1 Each pump shall be supplied with a well cap assembly to meet the following specifications;

2.2.3.2 The system shall include a well head cap assembly designed to support the weight of the down-well system components and limit the access to the well to prevent accidental contamination or damage.

2.2.3.3 The cap body shall be constructed of anodized aluminum, require less than ¼" vertical clearance between the top of the casing and the underside of any existing protective well closures, and be machined to fit standard well casing diameters without interference to allow easy installation and removal without modification. Manufacturer shall also be able to provide caps for specialized applications requiring water tight, or locking capabilities.

2.2.3.4 The pump air supply fitting shall consist of a compression-type brass fitting for connection to the pump air supply tubing, and a quick-connect brass fitting for connection to the controlled air supply hose.

2.2.3.5 The pump discharge fitting shall be a bore-through design that allows the discharge tubing to pass continuously through the cap, preventing sample water from contacting the fitting. The cap shall also include a flexible discharge tube, constructed of inert materials, which attaches via a slip fit grip ring to the pump discharge tube end and stores between uses in the water level measurement hole.

2.2.3.6 The cap shall include an access hole for water level measurement and include a polyethylene dust protection cap to cover the entire cap to prevent accidental introduction of contaminants to the fittings or well.

2.2.3.7 The cap shall include as standard equipment a polyethylene tag with special writing surface to allow marking well identification and pump controller setting information.

2.2.4 Freeze Protection

2.2.4.1 Each pump shall be provided with freeze protection that shall meet the following specifications;

2.2.4.2 The cap shall include a means of freeze protection that will allow for the positive discharge of any water in the tubing to prevent blockage of flow due to ice formation or damage to the pump discharge tubing near the well head.

(Choose for Freeze Protection Kit-MicroPurge Applications)

2.2.4.3 The freeze protection kit shall consist of a length of flexible polyethylene tubing 0.125" OD with a quick-connect brass fitting allowing connection to the controller compressed gas supply hose end. Water in the discharge tube near the wellhead can be removed by inserting the 0.125" tube into the pump liquid discharge tube end at the wellhead, then applying gentle drive gas pressure to the 0.125" tube. An optional in-line filter shall be available for removal of organic and particulate contaminants from the gas supply if desired.

(Choose for freeze prevention in standard 3-5 well volume applications)

2.2.4.4 A special tube coupler of appropriate size and material with a .020 inch diameter drilled hole installed shall be supplied to allow for drain back and prevent in-line freezing once sampling is completed.

2.2.5 Pump Controller

2.2.5.1 Each pump system shall be supplied with a pump controller to meet the following specifications;

2.2.5.2 Pump Controller (MP10 option)

2.2.5.2.1 The system shall include a pump controller to control the air on/off cycles (pump discharge/refill cycles) and regulate the air supply pressure under a wide range of field conditions.

2.2.5.2.2 The controller shall be an electronic/pneumatic design with microprocessor control, powered by replaceable AA alkaline batteries. The batteries shall allow for 200 hours continuous operation (at an average of four cycles per minute) without replacement. A battery test button on the control panel shall allow for instant determination of remaining battery life without suspending controller operation.

2.2.5.2.3 The control panel shall have a six-key membrane keypad and LCD display with the following features:

2.2.5.2.3.1 Up and Down arrow keys that can be used to increase or decrease pump flow rate with a single button push, controlling both discharge and refill timers simultaneously.

2.2.5.2.3.2 A LCD display of 2 lines by 16 characters that displays pump cycle time intervals, timer setting ID number, cycle time remaining, cycle mode indicator, and cycles per minute;

2.2.5.2.3.3 Three user-selectable operating modes as follows:

2.2.5.2.3.3.1 MicroPurge (MP) Mode - allows rapid flow rate optimization;

2.2.5.2.3.3.2 ID Mode – allows recall of previous ID number settings established for each well for precise flow rate control at each sampling event;

2.2.5.2.3.3.3 Manual (MN) Mode – allows user to directly set cycle timers for deep wells or other special cases.

2.2.5.2.3.4 Discharge and refill cycle timers that can be adjusted in 0.1-second increments in the Manual operating mode.

2.2.5.2.3.5 A "Hold/Cycle/Sample" button that suspends automatic pump cycling and allows the user to manually control the pump discharge and refill modes for simplified sample collection.

2.2.5.2.3.6 A quick-reference cycle indicator that displays red when the controller is in the discharge cycle and black when in the refill cycle.

2.2.5.2.4 The controller shall display an identification number for any flow rate setting in MicroPurge mode that allows the user to recall the setting for precise flow rate reproduction at subsequent sampling events.

2.2.5.2.5 The controller shall have pump drive air regulator (throttle) to control air pressure applied to the pump, and a pressure gauge that reads actual pressure applied to the pump, even when the pump is not cycling. The regulator shall be a multi-turn design, allowing the

user to control the pressure from 0 to 120 PSI. The pressure gauge shall be graduated in both pressure (in PSI) and pump depth (in feet).

2.2.5.2.6 The controller shall have a working pressure rating of 120 PSI, and be capable of operating pumps to a depth of 250 feet.

2.2.5.2.7 The controller shall have an operating temperature range of -20^{o} to $+150^{o}$ F (-29^{o} to 66^{o} C).

2.2.5.2.8 The controller shall be housed in a structural resin plastic case, resistant to impact, shock, oil, fuel, solvent, acid, and cold/heat, with corrosion resistant latches and hinge hardware and an air-tight gasket seal between the case body and lid. The case dimensions must not exceed 11" x 10" x 5" and should weigh no more than 6 pounds.

2.2.5.3 Pump Controller and Power Pack (MP15 option)

2.2.5.3.1 The system shall include a pump controller to control the air on/off cycles (pump discharge/refill cycles) and regulate the air supply pressure under a wide range of field conditions. The controller must be able to be operated by an external compressor or compressed gas cylinder.

2.2.5.3.2 The controller shall be an electronic/pneumatic design with microprocessor control, powered by replaceable AA alkaline batteries. The batteries shall allow for 200 hours continuous operation (at an average of four cycles per minute) without replacement. A battery test button on the control panel shall allow for instant determination of remaining battery life without suspending controller operation.

2.2.5.3.3 The control panel shall have a six-key membrane keypad and LCD display with the following features:

2.2.5.3.3.1 Up and Down arrow keys that can be used to increase or decrease pump flow rate with a single button push, controlling both discharge and refill timers simultaneously.

2.2.5.3.3.2 A LCD display of 2 lines by 16 characters that displays pump cycle time intervals, timer setting ID number, cycle time remaining, cycle mode indicator, and cycles per minute;

2.2.5.3.3.3 Three user-selectable operating modes as follows:

2.2.5.3.3.3.1 MicroPurge (MP) Mode - allows rapid flow rate optimization;

2.2.5.3.3.3.2 ID Mode – allows recall of previous settings established for each well for precise flow rate control at each sampling event;

2.2.5.3.3.3.3 Manual (MN) Mode – allows user to directly set cycle timers for deep wells or other special cases.

2.2.5.3.3.4 Discharge and refill cycle timers that can be adjusted in 0.1-second increments in the Manual operating mode.

2.2.5.3.3.5 A "Hold/Cycle/Sample" button that suspends automatic pump cycling and allows the user to manually control the pump discharge and refill modes for simplified sample collection.

2.2.5.3.3.6 A quick-reference cycle indicator that displays red when the controller is in the discharge cycle and black when in the refill cycle.

2.2.5.3.4 The controller shall display an identification number for any flow rate setting in MicroPurge mode that allows the user to recall the setting for precise flow rate reproduction at subsequent sampling events.

2.2.5.3.5 The controller shall have pump drive air regulator (throttle) to control air pressure applied to the pump, and a pressure gauge that reads actual pressure applied to the pump, even when the pump is not cycling. The regulator shall be a multi-turn design, allowing the user to control the pressure from 0 to 120 PSI. The pressure gauge shall be graduated in both pressure (in PSI) and pump depth (in feet).

2.2.5.3.6 The controller shall have a working pressure rating of 120 PSI, and be capable of operating pumps to a depth of 250 feet.

2.2.5.3.7 The controller shall have an operating temperature range of -20° to $+150^{\circ}$ F (-29° to 66° C).

2.2.5.3.8 The power pack shall consist of a lightweight aluminum compressed CO_2 cylinder and two-stage CO_2pressure regulator. The CO_2 cylinder should hold at least 5 pounds of compressed gas.

The cylinder should be able to operate the controller for a minimum of 3 hours of continuous operation when fully charged (pump depth of 75 feet/23 meters at 4 CPM).

2.2.5.3.9 The controller shall include a heavy-duty nylon fabric, padded, zippered backpack style full enclosure, with padded shoulder straps for ease of transport.

2.2.6 Water Level Meter and Drawdown Controller (MP30 option)

2.2.6.1 The system shall be a portable, tape-reel type, dual-purpose instrument for measuring water levels and controlling maximum drawdown in monitoring wells. It shall be capable of automatically sensing when the well's water level drawdown exceeds a user-determined level, and transmitting that signal to the pump controller via an included control cable.

2.2.6.2 System specifications will include:

2.2.6.2.1 Case size of 14" x 10.5" x 8.0" (L x W x H); (27 x 27 x 20 cm)

2.2.6.2.2 Weight of 7 pounds (3.2 kg)

2.2.6.2.3 Removable electronics for easy decontamination and battery changes.

2.2.6.2.4 Tape storage reel will include a positive braking system, wellhead hanging bracket, carrying handle and probe holder.

2.2.6.2.5 Power will be supplied by an internal 9 VDC battery capable of approximately 30-40 hours of portable operation.

2.2.6.2.6 Sensing probe will be 5/8" OD x 7.5" L (1.6 x 19 cm).

2.2.6.2.7 Tape lengths will be available in either 150' or 300' lengths of premium, flat-profile, stretch-resistant polyethylene-coated steel with permanent, recessed, length graduation markings to 0.01', traceable to USGGG-T-106E, EEC Class II standards.

2.2.6.2.8 Meter shall include an electrical output port and mating

cable to connect to pump controller, to signal the pump controller to override pump cycling operations when maximum pre-set drawdown level has been exceeded.

2.2.6.2.9 Meter shall include a mode switch to allow use in either drawdown control mode or standard water level measurement mode.

2.2.6.2.10 Meter will have a sensitivity adjustment, an audible buzzer and an LED indicator to indicate when the sensing probe enters a "dry" condition when in drawdown control mode, and when the sensing probe has entered a "wet" condition when used in a standard water level measurement mode.

2.2.7 Compressed Air Supply (MP40 option)

2.2.7.1 The air compressor/engine system shall be fully enclosed within a welded aluminum perimeter cage for easy lifting and protection of all components during transport, and shall be capable of supplying air to the controller at a rate of 2.2 SCFM at 125 PSI. The weight of the compressor assembly shall be 48 lbs. Dry. The compressor system will include an air hose with fittings for connecting the compressor to the pump controller.

2.2.7.2 The air compressor shall be of oilless design, with no lubricating oil in any chamber or component, to prevent potential contamination to the sample in the event of malfunction. The air compressor shall be powered by a clean-running, four stroke, 4.0 Hp Honda gasoline engine with no oil and gasoline mixing and shall be of a direct-coupled compressor design, without pulleys or belts.

2.2.7.3 Compressor system shall also be available with an optional wheeled cart to accommodate the air compressor/engine assembly for easy compressor transportation. The cart shall be fabricated of steel, reinforced by a longitudinal support beam on the underside of the cart platform, and painted to aid in chemical and corrosion resistance. The base of the cart shall be constructed of 10-gauge (.1345 inch) steel. The tires shall be sixteen-inch high, pneumatic high-flotation type.

2.2.7.4 Compressor system shall also be available with an optional air

hose reel capable of storing up to 200 ft. of air hose and designed to attach to the compressor cage.

2.2.7.5 Compressor system shall also be available with an optional propane conversion kit to convert the compressor engine to use propane as its fuel.

2.2.8 Compressed Air Supply (Model 3020 option)

2.2.8.1 The air compressor shall be of oilless design, with no lubricating oil in any chamber or component, to prevent potential contamination to the sample in the event of malfunction. The air compressor shall be powered by a 12 volt DC motor and shall be of a direct-coupled compressor design, without pulleys or belts.

2.2.8.2 The air compressor shall be capable of supplying air to the controller at a rate of 0.21 SCFM at 100 PSI. to facilitate operating pumps at depths of up to 75' deep. The weight of the compressor shall be 15 lbs. Compressor's case dimensions shall be 15" x 11" x 6.5".

2.2.8.3 The compressor system shall include air hoses, power cables and battery clamps such that it can be powered by a 12-volt DC battery (battery not supplied).

2.2.9 Specification for Flow Cell

2.2.9.1 Each flow cell system shall meet the following specifications;

2.2.9.2 The manufacturer shall warrant the system for three (3) years, including the sensors, sonde and meter. The system shall consist of a multi-parameter sonde combined with an engineered flow cell that allows measurement from a continuous stream of water and a display/data logger meter, as a complete system with all necessary parts, manuals and carrying/usage/storage case, having the following features and specifications:

2.2.9.3 The sonde shall be capable of measuring temperature, specific conductance, pH, oxidation-reduction potential (redox), and dissolved oxygen (DO) with additional, derived parameters of Total Dissolved Solids (TDS) and Salinity. The Specific Conductance, pH, DO and ORP probes shall all be capable of direct calibration to known standards. See data sheets for specifications.

2.2.9.4 The sonde shall have individual probes for pH/ORP, specific

conductance and dissolved oxygen that are removable for service or replacement in the field.

2.2.9.5 The pH/ORP probe shall have a separate, user-serviceable, reference-junction probe consisting of a Teflon membrane and KCL reservoir. The system shall include a spare Teflon membrane to extend the anticipated life of the pH/ORP probe to 4-6 years. Spare replacement membranes shall be available from the manufacturer.

2.2.9.6 The dissolved oxygen sensor shall use an included standard sample circulator technology to improve accuracy under low flow conditions.

2.2.9.7 The unit shall be Year 2000/CE compliant.

2.2.9.8 The hand-held meter shall have a simplified 5-key keyboard and a 3.5" by 3.5", high-resolution LCD display. The unit shall allow for continuous, toggled display of all measured and calculated parameters on a single LCD display, with a minimum of 6 lines x 20 characters.

2.2.9.9 The meter shall have an internal memory for data storage. The meter shall be capable of automatically recording up to 100 data points sets.

2.2.9.10 The meter shall be powered by 3 C-sized alkaline batteries capable of powering the meter for continuous usage of up to 12 hours.

2.2.9.11 The meter shall include proprietary software capable of monitoring, data logging, and user-alerting of parameter stabilization, at user selected intervals between 1 and 9 minutes, of any or all of the following parameters including: pH, Conductivity, DO and/or ORP over any three consecutive intervals. Parameter stabilization to be based on:

2.2.9.11.1 3 consecutive readings of user-selected parameters within user-selected limits, at user-selected time-intervals, including one or more of the following parameters: pH, conductivity, dissolved oxygen, and ORP (redox).

2.2.9.11.2 Default Parameter Stabilization range criteria:

2.2.9.11.2.1 pH - ± 0.2 units

2.2.9.11.2.2 DO - ± 0.2 mg/L

2.2.9.11.2.3 Conductivity - ± 0.020 mS/cm

2.2.9.11.2.4 ORP - ± 20 millivolts

2.2.9.12 The included flow cell shall be flow-engineered and allow for good distribution of flow of water over the sensors, without direct, high-velocity jetting toward the sensors or stagnant zones, and handle flow rates up to GPM without modification, and up to 10.0 GPM using an optional flow diverter.

2.2.9.13 The flow cell body shall be a one-piece, molded design which attaches to the sonde with a ¼ turn bayonet-type closure.

2.2.9.14 The cell shall have a tangential liquid inlet port at the bottom and outlet port at the top of the cell, with an outlet design that prevents the buildup of trapped air in the cell. The cell shall be designed to operate either vertically or horizontally without trapping air in the cell.

2.2.9.15 The standard cell volume shall not exceed 175 ml.

2.2.9.16 The flow cell shall be easily disassembled in the field without tools for cleaning and storage.

2.2.9.17 The systems shall be housed in an included structural resin case, resistant to impact, shock, oil, fuel, solvent, acid, and cold/heat, with corrosion resistant latches and hinge hardware. The case shall have a closed-cell foam insert designed to hold and protect the specific system components, and allow the sonde/flow cell unit to be used while in the case.

2.2.9.18 The system shall include all necessary parts and fittings to attach to either semi-rigid or flexible inlet tubing in 1/4", 3/8" and 1/2" OD sizes. The fittings shall allow for quick connection and disconnection of the inlet tubing without tools.

2.2.9.19 The system shall include 10 feet of flexible inlet/discharge tubing.

2.2.9.20 The system shall include an operation and maintenance manual with system hook-up diagrams and a plastic laminated quick-reference instruction card.

2.2.9.21 The system shall include replacement KCl solution and membranes for the DO sensor.

2.2.9.22 The system shall include a plastic calibration/storage cup and a provision for storing the sonde, with all sensors installed, in water, alcohol or KCl storage solution.

2.2.9.23 The manufacturer shall offer a 24-hour, toll-free technical support hotline for user start-up and assistance.

2.2.10 General System Specifications and Vendor Requirements

2.2.10.1 The manufacturer shall have a minimum of 15 years experience providing pneumatic bladder pumps in groundwater monitoring applications.

2.2.10.2 The entire system shall be covered by a standard one-year warranty provided by the manufacturer, with the exception of the bladder pumps which shall be covered by a standard ten-year warranty as noted in A.12 above.

2.2.10.3 The manufacturer shall provide full product technical support by telephone during normal business hours, and additional 7 day/24 hour support via a toll-free telephone hotline.

2.2.10.4 The manufacturer shall have a local factory trained agent, and shall have OSHA certified technicians available for installation or start-up assistance.

2.2.10.5 The manufacturer shall have a minimum of eleven (11) years experience with a pump certification program as described in 2.2.1.8.

2.2.10.6 Manufacturer's facility shall include a 300' test well for flow rate verification.

2.2.10.7 Manufacturer must be capable of shipping all standard equipment within ten working days of receipt of order.

2.2.10.8 All bladder pumps, downwell tubing, well caps, controller, and flow-cell to be supplied by:

QED Environmental Systems, Inc.
P.O. Box 3726
Ann Arbor, MI 48106
(800) 624-2024 (734) 995-1170 FAX
www.qedenv.com

ENGINEERING DATA SHEET 1
MULTI-PARAMETER IN-LINE WATER QUALITY ANALYZER SYSTEM
(MP20 option)

The sensors shall have the following typical performance specifications:

Sensor	Range	Resolution	Accuracy
Temperature	-5 to +50 °C	0.01 °C	± 0.20° C
pH	0 to 14 Units	0.01 Units	± 0.2 Units
ORP	-999 to 999 mv	1 mV	± 20 mV
DO (mg/l*)	0-20 mg/L	0.01 mg/L	± 0.2 mg/L
DO (% Saturation**)	0-200%	0.1%	± 2%
Salinity*	0-70 PSS	0.01 PSS	±1% of reading ± 1 count
TDS*	Calculated		

NOTE: * - Readings calculated from other measurements;
** - Air Saturation

Sonde Operating Environment

Medium	Fresh, sea or polluted water
Temperature	-5° to +50°C
Storage Temperature	+1° to +50°C

